

# Hologram Viewers

## Objectives

Students (K-4) research the physics of holograms and distinguish differences between living and inanimate objects.

Students (5-6) collect and analyze science and technology information about where holograms are used today and how they could be used in the future.

Students use tools and precise construction methods to assemble a three-dimensional viewer that creates the illusion of length, width, and depth.

## Multiple Intelligences

Interpersonal

Naturalist

Spatial

## What Does It Mean?

**Hologram:** a flat image, created with laser light, that looks three-dimensional

**Illusion:** a false or misleading impression of reality, fantasy

## National Standards

### Visual Arts Standard #2

Using knowledge of structures and functions

### Visual Arts Standard #6

Making connections between visual arts and other disciplines

### Science Standards

Evidence, models, and explanations

Form and function

### Science and Technology

Abilities to distinguish between natural objects and objects made by humans

Abilities of technological design

### Science as Inquiry

Understanding about scientific inquiry

### Physical Science

Grades K-4

Light, heat, electricity, and magnetism

## Background Information

If you have ever visited Disneyworld or Disneyland and experienced the Haunted House you most likely have seen a hologram. Holograms are amazing photographs. Technically, to make a hologram the light that is reflected off objects is reconstructed. The inventor of the first holographic image was Dennis Gabor, a Hungarian physicist. He won a Nobel Prize in Physics in 1971 for his invention.

Today holograms are useful in many ways, such as medical imagery in CT scans. Holograms are found on products to get a buyer's attention. Many drivers' licenses and currencies have holograms embedded within their designs.

Holograms can also be used for data storage. Every document ever written from ancient times until today could be stored in a hologram the size of a human brain!

## Resources

*Shoebox Holography* by Frank DeFrietas

Step-by-step manual for older students. Shows how to make a tabletop-size hologram without expensive equipment.

*The Complete Book of Holograms* by Joseph E. Kasper  
Written for older students. Clear explanation of holography and how it works. Detailed instructions on how to make a hologram.

*The Mirrorstone* by Michael Palin

Ages 9 to 12 enjoy the holograms, which integrate beautifully into the watercolor illustrations. Story about magic and time travel.

*The Rainbow Fish* by Marcus Pfister

Popular story about inner beauty for young children. Richly illustrated with holograms and watercolors.

## Vocabulary List

Use this list to explore new vocabulary, create idea webs, or brainstorm related subjects.

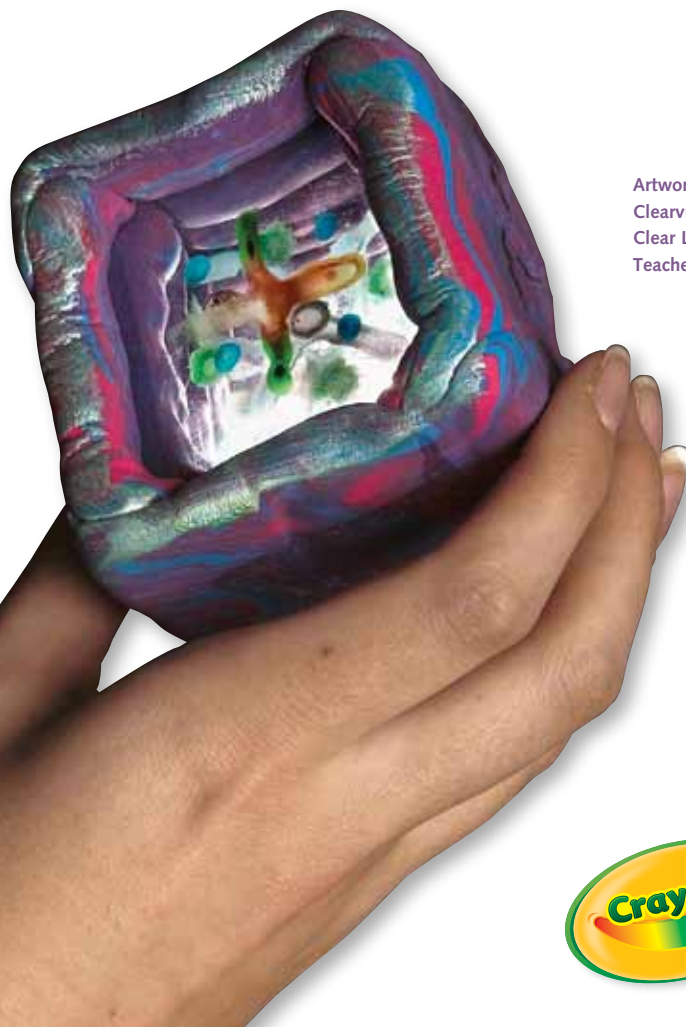
Depth  
Dimensions  
Energy  
Form  
Height  
Hologram  
Holography  
Illusion  
Image

Laser  
Light  
Light wave  
Mold  
Patterns  
Photograph  
Plane  
Reconstruction  
Reflection

Refraction  
Shadow  
Shape  
Slides  
Texture  
Three-dimensional  
Transparent  
Two-dimensional  
Width



Artwork by students from  
Clearview Elementary School,  
Clear Lake, Minnesota.  
Teacher: Kathy Gerdtz-Senger




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**Dream~Makers**  
Building fun and creativity into standards-based learning

# Hologram Viewers

	K-2	3-4	5-6
<b>Suggested Preparation and Discussion</b>	<p>Display illustrations and samples of holograms, including magazine and book covers, expired credit cards, holographic packaging, hologram sunglasses, and other items.</p> <p>Ask: Has anyone ever seen a hologram? How do a photograph and a hologram differ? Compare a 3-D hologram with a 2-D or flat photograph. Use objects such as spheres, cubes, and rectangular prisms as examples of 3-D. Review the two dimensions (width and height) seen in a photograph and explain the added dimension of depth (thickness) visible in a hologram. The added dimension of depth allows people to see “into” the hologram.</p> <p>Explain that holographic lenses bend light. Looking at holograms is like looking at something that is really in front of your eyes, but if you reach to touch, your hand will close on air.</p>		
	<p>Study the cover of <i>The Rainbow Fish</i>. Ask: What looks different with the scales? How does the light get inside?</p>	<p>Describe the power of holograms. If viewed under a microscope, a hologram of a leaf with a droplet of water on it could reveal even the one-celled organisms living in the water droplet!</p> <p>Light travels fast (186,000 miles/second) and straight. What is 186,000 miles away from Earth?</p>	
	<p>Demonstrate how to create a holographic viewer with slides that create the illusion of a third dimension. Students work in small groups to create their viewers.</p>		
<b>Crayola® Supplies</b>	<ul style="list-style-type: none"> <li>• Glitter Glue</li> <li>• Markers</li> <li>• Model Magic®</li> <li>• Paint Brushes</li> <li>• School Glue</li> <li>• Tempera Mixing Mediums</li> <li>• Watercolors</li> </ul>		
<b>Other Materials</b>	<ul style="list-style-type: none"> <li>• Paper plates</li> <li>• Recycled clear plastic food containers</li> <li>• Rulers</li> <li>• Water containers</li> </ul>		
<b>Set-up/Tips</b>	<ul style="list-style-type: none"> <li>• Ask parents to collect clear plastic food containers. Heavy-weight transparency film can also be used for the slides.</li> <li>• Cover painting surface with recycled newspaper.</li> </ul>		
<b>Process: Session 1 15-20 min.</b>	<p><b>Create slides</b></p> <ol style="list-style-type: none"> <li>1. Team members measure and cut smooth, flat surfaces of plastic containers into five squares or rectangles, all the same size.</li> <li>2. Blend watercolors with a mixing medium on a paper plate. Load a brush with the mixture.</li> <li>3. In the center of two viewer slides, paint a design smaller than the diameter of a penny.</li> <li>4. In the center of two other slides, carefully paint slightly larger designs.</li> <li>5. On the fifth side, paint a large design that takes up most of the space. Air-dry the slides.</li> </ol>		
	<div style="display: flex; align-items: center; justify-content: center;"> <div style="flex: 1;"> <p><b>Holographic Portrait</b> Artist unknown Glass film sheet with image 2" x 1/8" Private Collection.</p> </div> <div style="flex: 2;">  </div> </div>		

	K-2	3-4	5-6
<b>Process:</b> <b>Session 2</b> <b>20-30 min.</b>	<b>Assemble viewer</b> <ol style="list-style-type: none"> <li>Flatten a tennis ball amount of Model Magic® compound into a 1/2-inch thick, rectangular slab.</li> <li>Place slab on a flat surface. Carefully press the slides with painted circles into the slab. Arrange circles in this sequence: small, medium, large, medium, small. Press slides into the compound parallel to each other and about 1/4 inch apart.</li> <li>Make two more identical Model Magic slabs. Place them on both sides of the slides to hold them in place. Make sure the slides stand straight!</li> <li>Create one more slab. Press it on top of the viewer to create a box around the slides. Air-dry at least 24 hours.</li> </ol>		
<b>Process:</b> <b>Session 3</b> <b>10-15 min.</b>	<b>Decorate viewer</b> <ol style="list-style-type: none"> <li>Use markers to add decorative shapes, patterns, and textures to the surface of the viewer case. Add glitter glue for dramatic effects. Air-dry viewer.</li> </ol>		
<b>Process:</b> <b>Session 4</b> <b>30-45 min. or more</b>	<b>Explain the effect</b> <ol style="list-style-type: none"> <li>Show other children the viewers. Explain hologram technology and how holograms are different from typical photo images.</li> </ol>	<b>Research and write about holograms</b> <ol style="list-style-type: none"> <li>Research and collect examples of how holograms are used in various ways such as the haunted house in Disneyland or Disney World, driver's licenses, or other forms of technology.</li> <li>Write a paragraph that tells others how you would use holograms constructively.</li> </ol>	
<b>Assessment</b>	<ul style="list-style-type: none"> <li>Student groups look through other groups' viewers to see if a dimensional form portraying length, width, and depth was created. Discuss possible reasons why any forms lack dimension.</li> <li>Students verbally explain the difference between a hologram and a photograph.</li> <li>Ask students to reflect on this lesson and write a DREAM statement to summarize the most important things they learned.</li> </ul>		
	<ul style="list-style-type: none"> <li>Students write a paragraph explaining current applications of holography and another predicting its future applications.</li> </ul>		
<b>Extensions</b>	<p>Younger children and those with learning challenges may benefit from additional concrete explorations of light. Define light as energy we can see. Light rays can be controlled in three ways: block, reflect, and bend. Demonstrate light ray control. Use a flashlight to cast a shadow. Change the path of light with an unbreakable mirror. Place a spoon in a transparent water-filled container to show how light rays can be bent. Look at the shape of the spoon above and below the water line.</p> <p>Set up an area where children can safely explore the effects of blocked, bent, and reflected light.</p>		<p>Compare and contrast film images, digital images, and holographic images—and the equipment used to create them.</p> <p>Challenge academically talented students to investigate the use of lasers in creating holographic images. Have them prepare a report and visual aids to share with the class.</p>
	<p>Borrow an antique stereoscope and enjoy the 3-D effects of those photographs. Try to duplicate the 3-D effects by shifting digital camera images, printing, mounting, and viewing them through the stereoscope.</p> <p>Research how to create pinhole cameras, which use light to create images on film.</p>		
<p><b>How to assemble a hologram viewer</b></p> 